CONSONANT MUTATION IN PULAAR

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1.0 Introduction

The phenomenon of morphologically conditioned consonant mutation in Fula (Atlantic, Niger-Congo), in which a stem-initial consonant can surface as one of three homorganic variants as shown in (1), has been an important case study in the development of autosegmental phonology and has consequently been treated extensively in the literature on underspecification, starting with Lieber (1984)

(1)	blind person	woman	
	gum-ɗo	*debb-o*	singular
	wum-ɓe	*rew-ɓe*	plural
	ngum-kon	*ndew-on*	diminutive plural

Notwithstanding, there has been no consensus on which of the three variants involved in the mutations is actually the underlying form While no scholars have posited the prenasalized stop forms as underlying, Skousen (1972), in the first generative account, made arguments in favor of underlying plain stops, Anderson (1976), Churma (1986), Paradis (1987a, 1987b) and Niang (1997) have either assumed or argued in favor of underlying continuants, and Lieber (1984, 1987) begs the question by positing an underspecified underlying form which corresponds to none (or all) of the mutating surface forms Given this lack of consensus, identifying the underlying forms in Fula is clearly problematic, and the problems are due in large part to a discrepancy between the phonological and morphological behavior of mutations Fula mutation involves a synchronic chain shift along a three point scale with regard to the morphological behavior of stems, stops must be derived[1] from continuants, but phonologically, prenasalized stops must be derived from plain stops These two facts must somehow be incorporated coherently into an analysis of Fula, a task that this article attempts to undertake

Recent lines of inquiry within the non-derivational grammatical paradigm of OT have called into question the notion of an underlying representation (Hammond 1995, 1996, Russell 1995, Burzio 1999) Hammond (1995, 1996) and Russell (1995) argue that the phonological shape of morphemes is directly encoded in the constraint hierarchy, thereby rendering URs unnecessary Parallel lines of inquiry have expanded the version of Correspondence Theory articulated by McCarthy and Prince (1995) to include an axis of identity between morphologically related surface forms Focusing on over- and underapplication effects in reduplication, McCarthy and Prince (1995) claim a set of identity relations that hold between both input (UR) and output (surface) forms, and, most germanely, between base and reduplicant The surface-to-surface identity between base and reduplicant, an approach which provides a natural explanation for traditionally problematic phenomena such as the copying of phonological material from the reduplicant back onto the base (overapplication), is expanded by Benua (1997), in a theory of Transderivational Identity, to include surface-to-surface identity between all outputs that share a base In Benua's view, morphologically related words derived from the same base are required to be phonologically identical by an output-to-output correspondence relation, OO-F Burzio (1999) further privileges output-output faithfulness in a seemingly radical reworking of the concept of morphology as a set of surface-to-surface relations by reducing WFRs to ranked constraints with no reference to URs As

[1] The term derivation is used in this paper to mean simply the result of affixation It does not imply a pre-OT serial model of the grammar

starting points for a derivation URs are in a sense artifacts of a serial model that makes - as Burzio (1999 1) puts it - "an odd bedfellow to parallel OT "

In this paper I argue in favor of an approach to Fula consonant mutation in which URs are abandoned in favor of morpheme constraints My analysis builds on the insights of a similar approach to Fula mutation developed by Elzinga (1996) but arrives at different conclusions Where Elzinga posits stop-initial nominal forms as basic I posit continuant-initial forms, based on convincing evidence that there is no [+continuant] morpheme in Fula that could provoke continuancy mutation In addition, my analysis appeals crucially to output-to-output identity constraints (OO-F) The data in this study are from Pulaar[2], a dialect of Fula spoken in Senegal which exhibits typical mutation patterns consistent with those of other dialects described in the literature In addition to corpus internal evidence for my arguments, supporting evidence from the behavior of loanwords in Pulaar further strengthens the basis for my claims

2 0 The facts of Pulaar

Consonant mutation in Pulaar is morphologically conditioned by noun class for nouns and primarily by number for verbs although there are other criteria such as focus that also condition mutation in verbs Verbal stems exhibit only a two-way alternation between a continuant (or sometimes stop) and a prenasalized stop while nouns exhibit the complete three-way range of possible mutations in Pulaar These expository comments will thus focus on the behavior of nominal stems [3]

2 1 Mutation in noun stems

In Pulaar, the voiceless stop t, the glottalized stops ɓ, ɗ and ƴ the plain nasals m, n, ñ and ŋ, and the liquid l do not undergo mutation, all other consonants, however, take part in the mutation system Mutation can be viewed as the affixation of a feature or features to the root node of a mutating consonant (Lieber 1984, 1987, Akinlabi 1996) In the case of Pulaar, the floating feature is a prefix that constitutes part of the class morpheme and co-occurs with a class suffix The typical nominal stem in Pulaar undergoes initial consonant mutation depending on the noun classes to which it is assigned There are twenty one classes in Pulaar and a single noun stem may belong to up to as many as six distinct classes, as in the paradigms in (2)

(2)	knee		hole		
	hofru	Class 5	*wuddere*	Class 3	singular
	koppi	Class 18	*gudde*	Class 17	plural
	kofel	Class 19	*guddeji*	Class 19	diminutive singular
	kofon	Class 21	*nguddon*	Class 21	diminutive plural
	kofal	Class 9	*guddal*	Class 9	augmentative singular
	kofeeje	Class 17	*guddeeje*	Class 17	augmentative plural

Consonants that undergo mutation may have up to three homorganic variants which, following Arnott (1971), have been termed GRADES The three grades of a given consonant are known as a GRADATION SET Pulaar exhibits nine gradation sets, each of which alternates between a continuant, a stop, and a prenasalized stop [4] These are given in (3)

[2] I thank Thiemo Seydou Sall for providing the data on which this study is based, and Mary Teuw Niane for helping me fill in the few remaining lacunae that came to light as I was writing up the analysis

[3] Fula has been well described in the linguistic literature, most notably in Arnott's (1970) detailed volume on the nominal and verbal systems of the language

[4] Voiceless consonants do not undergo prenasalization for reasons that will become clear later, nevertheless, the rubric is retained as a convention

(3)	LABIAL		CORONAL			DORSAL			
a continuant	w	f	r	s	y	h	y	w	ʔ
b stop	b	p	d	c	ɟ	k	g	g	g
c prenasalized	mb	p	nd	c	nɟ	k	ng	ng	ng

In stems that undergo mutation a given noun class always conditions the same grade, either a, b, or c, regardless of the gradation set Thus, for example, Class 1, which contains human singular nouns as well as loanwords, conditions the b-grade, and Class 2, which contains human plural nouns, conditions the a-grade For fully mutating stems, nouns in Class 1 begin with a stop, while those in Class 2 begin with a continuant Examples are given in (4)

(4)	Class 1	Class 2	
	baylo	*wayluɓe*	blacksmith
	bileejo	*wileeɓe*	magician
	paho	*fahɓe*	deaf person
	pullo	*fulɓe*	Peul (Fulani person)
	debbo	*rewɓe*	woman
	dono	*ronooɓe*	heir
	cafroowo	*safrooɓe*	healer
	ceerno	*seernaaɓe*	marabout (Koranic teacher)
	ɟeeyoowo	*yeeyooɓe*	trader
	ɟiʔowo	*yiʔooɓe*	seer
	kaɟɟoowo	*haɟɟooɓe*	pilgrim to Mecca
	koɗo	*hoɓɓe*	stranger, guest
	guɟɟo	*wuyɓe*	thief
	giʃiraaƭo	*yiʃiraaɓe*	peer
	gorko	*worɓe*	man
	gumɗo	*wumɓe*	blind person
	gawlo	*ʔawluɓe*	griot
	gawoowo	*ʔawooɓe*	fisherman

Of the twenty-one classes in Pulaar, Classes 2, 3, 5, 6, 7 and 14 condition the a-grade, Classes 1, 9, 10, 15, 17, 18, 19 and 20 condition the b-grade, and Classes 4, 8, 11, 12, 13, 16 and 21 condition the c-grade, thus the distribution of grades is more or less even across classes, with each grade appearing in 7 (± 1) forms

In addition to fully mutating stems in which all three members of a gradation set occur, Pulaar also has stems which remain invariable and do not undergo mutation, as well as partially mutating stems in which two of the three forms occur in environments where we would normally expect all three The distribution of grade occurrence across stems is as follows [5]

(5)				
	Fully mutating	continuant	stop	nasal
	Partially mutating		stop	nasal
	Non-mutating	continuant		
			stop	
				nasal

[5] Previous analyses of Fula, including those of Paradis (1987a and b) who uses data from a closely related dialect, have not attested to the existence of the invariable continuant-initial stems found in this dialect

Stems that mutate between a voiceless continuant and a voiceless stop do not undergo nasal mutation simply because of a constraint in Pulaar (NAS/VC) (cf Elzinga 1996) that does not permit voiceless prenasalized stops, and not because of any morphological stem constraint Such stems can thus be analyzed as a subcategory of fully mutating stems rather than partially mutating stems in which only continuant and stop forms occur The gaps in partially mutating stem types, then, are continuant/stop and continuant/nasal, facts that will be relevant to the analysis Examples of all nominal stem types and their classes are given in (6)

(6)	continuant	stop	nasal	
Fully mutating	*worɓe* 2	*gorko* 1	*ngoron* 21	man
	rewɓe 2	*debbo* 1	*ndewon* 21	woman
	hofru 5	*koppi* 18	*kofon* 21	knee
Partially mutating	*julaaɓe* 2	*jula* 1	*njulon* 21	trader
	baayooɓe 2	*baayo* 1	*mbaayon* 21	orphan
Non-mutating	*sukñaaɓe* 2	*sukña* 1	*sukñon* 21	soul-eater
	hoggooji 18	*hoggo* 7	*hoggoyon* 21	beak

From these stem patterns we can posit [-continuant] and [+nasal] class prefixes that attach to the root node of stem-initial continuants to produce the mutating forms

2 2 Mutation in verb stems

Verb stems exhibit two mutations, c-grade or nasal, which is characteristic of plural forms among others, and generally the a-grade or continuant form which is characteristic of most singular forms and infinitives among others Examples are given in (7)

(7)	Infinitive	singular	plural	
	waalde	*waala*	*mbaala*	spend the night
	fooftaade	*fooftoo*	*pooftoo*	rest
	rokkude	*rokka*	*ndokka*	give
	sippireede	*sippiree*	*cippiree*	wrestle
	yimde	*yima*	*njima*	sing
	heewde	*heewi*	*keewi*	be a lot
	wujjude	*wujja*	*ngujja*	steal
	ʔañde	*ʔañi*	*ngañi*	hate

In addition to continuant-initial infinitives stop-initial infinitives occur and even nasal stop-initial infinitives occur as shown in the examples in (8) Strikingly absent from this distribution, however, are voiceless stop-initial infinitives

(8)				
	baawde	*baawi*	*mbaawi*	overflow
	diwde	*diwii*	*ndiwii*	jump
	jooɗaade	*jooɗoo*	*njooɗoo*	sit down
	goobde	*gooba*	*ngooba*	dye
	ndaarde	*ndaara*	*ndaara*	look

(9) Fully mutating	continuant		nasal
		stop	nasal
Non-mutating			nasal

From this distribution of stem types we can posit a [+nasal] prefix that attaches to the root node of continuant- or stop-initial verbal stems to produce the mutated forms

3 0 Constraints on Pulaar consonant mutation

In morpheme-constraint based theories such as that of Hammond (1995), the phonological shape of a morpheme is encoded directly in the constraint hierarchy rather than in an underlying representation In his morpheme-constraint based analysis of Fula, Elzinga (1996) argues that stem behavior can best be accounted for by the ranking of morpheme constraints in relation to the featural alignment and parsing constraints that govern mutation In his analysis, stop-initial forms are basic, ie required by morpheme constraints The various types of stems (fully variable, partially variable, invariable) are then ranked judiciously between the align and parse constraints Fully variable stems are ranked lowest and therefore undergo both continuant and nasal mutation, partially variable stems are ranked below the alignment and parse constraints for the feature [+nasal] and above for the feature [+continuant], thereby undergoing nasal mutation but not continuancy mutation, and finally, invariable stems are ranked above both sets of align and parse constraints and do not, therefore, undergo mutation at all The superiority of such an approach lies in the natural way in which non-occuring stems are ruled out Because of the constraint hierarchy, any stem that undergoes continuancy mutation also undergoes nasal mutation, consequently, the occurrence of partially variable stems that alternate only between a continuant and a stop are rendered impossible The alternative -- encoding exceptionality as a diacritic in the underlying representation of each lexical item -- simply treats the non-occurrence of stems that alternate between a continuant and a prenasalized stop as an accidental gap In the following analysis I will show that while a morpheme-constraint based approach to Pulaar better accounts for consonant mutation in the language, positing continuant-initial rather than stop-initial basic forms yields a more felicitous account Recall that consonant mutation in Pulaar is typical and unexceptional, thus the analysis presented here is compatible with analyses of the same phenomenon in other Fula dialects, including the Nigerian Gombe and Adamawa dialects described by Arnott (1970) upon which Elzinga's (1996) analysis is based

In this analysis, I will assume that the basic form for nominal stems is continuant-initial If the basic form for nominal stems is continuant initial, then two types of mutation occur stop mutation and nasal mutation The former is the result of aligning the feature [-continuant], supplied by the class morpheme, with the left edge of the stem, while the latter involves a similar alignment of the feature [+nasal] [6] Alignment of a class prefix is ensured by the constraint in (10)

(10) ALIGN-Class
Align (Class 2, 3, 4, 5, 6, 7, 8, 11, 12, 13, 14, 16, 21, L, Stem L)
The left edge of the class$_x$ noun must be aligned with the left edge of the stem

Given that the same process of featural affixation (cf Akinlabi 1996) is occurring for classes that involve the prefixation of [-continuant] and [+nasal], and for the various verbal prefixes that involve the features

[6] Elzinga (1996), like Akinlabi, also requires a parse constraint for each of these features Kibre (1997 43) on the other hand, deems such a constraint unnecessary, and even anachronistic for a morpheme-constraint based approach His claim, with which I agree, is that deletion (a consequence of failure to parse) "can be described by simply allowing the existence of a segment as specified in a part of a morpheme constraint to be overridden by other (phonotactic) constraints " Consequently, alignment entails automatic parsing

[+nasal], I will subsume all instances of featural affixation in Pulaar under the featural alignment constraint given in (11)

(11) ALIGN-F
Align (Feat L, Stem L)
A featural affix must be aligned with the left edge of the stem

The tableaux in (12) and (13) show how mutation works using the noun stem for 'man' Alignment constraints dominate morpheme constraints on fully mutating stems

(12) *gorko* 'man' Cl 1

input wor-, [-cont]	ALIGN-F	STEM (wor-)
a ☞ gor- | [continuant]		*
b wor-	*!	

(13) *ngoron* 'man' Cl 21

input wor-, [+nasal]	ALIGN-F	STEM (wor-)
a ☞ ngor- | [+nasal]		*
b wor-	*!	

As mentioned in §2, stems that mutate between a voiceless continuant and a voiceless stop do not undergo nasal mutation This is due to a general phonological constraint in Pulaar, given in (14), that prohibits voiceless prenasalized stops, rather than to a parochial morpheme constraint Morpheme constraints on voiceless consonant-initial stems, then, are simply ranked with fully mutating stems of which they are a subcategory, and the constraint in (14) is ranked more highly than the alignment constraints

(14) NAS/VC
If [+nasal], then not [-voice]

The tableau in (15) illustrates the effect of this ranking

(15) *kofon* 'knee' Cl 21

input hof-, [+nasal]	NAS/VC	ALIGN-F	STEM (hof-)
a nkof- | [+nasal]	*!		*
b ☞ kof-		*	*

There is obviously much more to be said about the optimal candidate, including answering the question of why a voiced prenasalized stop initial consonant cannot be the optimal candidate, a question that Kibre (1997 42) poses, or why a stop form should be the optimal form when the stem is continuant-initial These and other issues will be addressed in §3 1

Non-mutating stems can be accounted for by ranking parochial morpheme constraints above the alignment constraints as shown in the examples in (16) and (17) for the stem *hoggo-* 'beak'

(16) *hoggooji* 'beak' Cl 18

input hoggo-,[-cont]	NAS/VC	STEM (hoggo-)	ALIGN-F
a koggo- [-cont]		*!	
b ☞ hoggo-			*

(17) *hoggoyon* 'beak' Cl 21

input hoggo-,[+nas]	NAS/VC	STEM (hoggo-)	ALIGN-F
a nkoggo- [+nasal]	*!	*	
b koggo-		*!	*
c ☞ hoggo-			*

We now have the constraint hierarchy in (18) in which constraints on invariable stems (STEM-i) are ranked higher than the alignment constraints that govern mutation, and fully mutating stems (STEM-m) are ranked below the alignment constraints

(18) NAS/VC >> STEM-i >> ALIGN-F >> STEM-m

Apart from the fact that I posit basic continuant-initial forms as opposed to his basic stop-initial forms, so far this analysis is similar to Elzinga's (1996) The question now arises as to where the constraints that govern partially mutating stems should be placed in the hierarchy In my view, no re-ranking of constraints is necessary, and only a very simple amendment to STEM-m to include both fully and partially mutating stems is necessary to account for the entire array of nominal stems in Pulaar This is accomplished by designating "partially mutating" stems as stop-initial in their basic form The low ranking of STEM-m with regard to ALIGN-CLASS allows all such stems to potentially undergo the full range of mutation These stems may be continuant-initial or stop-initial Given that the two types of mutation that can occur are stop mutation and nasal mutation, continuant-initial stems undergo both, while stop-initial stems undergo only nasal mutation since stop mutation would apply vacuously

Since Elzinga posits stop-initial basic forms, he is obliged to intersperse morpheme constraints on stem types among the two alignment constraints that condition mutation, ALIGN (CONT) and ALIGN(NAS), and which I have collapsed into a single ALIGN-F constraint Crucially, morpheme constraints on partially variable stems ($Stem_p$) have to be ranked above ALIGN (CONT) to rule out continuant-initial allomorphs, and below ALIGN (NAS) in order to allow nasal-initial allomorphs His constraint hierarchy is as follows

(19) NAS/VC >> Stem_l >> ALIGN(NAS) >> Stem_P >> ALIGN(CONT) >> Stem_V

In addition to accounting for nominal stem behavior in Pulaar in a simpler and thus presumably more felicitous way than Elzinga's analysis, my analysis has the advantage of applying equally well to verbal stems The plural prefix for verbs consists of the feature [+nasal], thus it is handled by the constraint ALIGN-F, and verbal stems are simply a subset of STEM-m This correctly predicts that all verbal stems will undergo prenasalization unless constrained by NAS/VC Both possibilities are illustrated in (20) and (21)

(20) *ndokkı* 'give' pl

input rokk-, [+nas]	NAS/VC	ALIGN-F	STEM (rokk-)
a ☞ ndokk- | [+nasal]			*
b rokk-		*!	

(21) *keewı* 'be a lot' pl

input heew-, [+nas]	NAS/VC	ALIGN-F	STEM (heew-)
a nkeew- | [+nasal]	*!		*
b ☞ keew-		*	*

As with example (15), example (21) raises certain questions Why should the optimal candidate not begin with a voiced prenasalized stop (*ngeew-*), which would satisfy both NAS/VC and ALIGN-F? If the input form is continuant-initial (*heew-*) why, in the absence of any featural alignment, is the optimal output form stop-initial (*keew-*)? In the next section, §3 1, I address these questions and account for the facts by appealing to notions of output-to-output identity

3 1 Output-to-output faithfulness

Benua (1997) proposes an extension of Correspondence theory (McCarthy and Prince 1995) to include surface-to-surface identity not only between base and reduplicant , but between all outputs that share a base, an axis of identity that she calls transderivational identity Output-to-output or OO faithfulness requires identity between pairs of words or, most significantly for our purposes, between derived members of a paradigm When paradigmatic identity constraints outrank other phonological constraints with which they interact directly, misapplication effects are the result To illustrate the point, the underlying consonant cluster that surfaces in the English words *signature* and *signify* is simplified in the tautosyllabic context of the word *sign* We would expect it to appear in unsimplified form in the heterosyllabic context of the word *signing*, but it does not, because OO faithfulness requires *signing* to resemble the form *sign* more than any underlying form

If we accept Benua's proposal that the unit of evaluation in output-to-output identity is a paradigm, and that paradigmatically related words are available to the phonology at the same time, we can now attempt to account for the problematic behavior of nominal and verbal paradigms in Pulaar The two problems that were pointed out in §3 0 both dealt with stems like those in (22) whose initial consonant is voiceless

(22)	knee (n)	wake up (v)
continuant	*hof-*	*fin-*
stop	*kof-*	
nasal	*kof-*	*pin-*

Why is the 'nasal' form of both these stems a voiceless stop? What rules out voiced prenasalized stop-initial forms, **ngof-* and **mbin-* respectively, as the optimal ones? And if ALIGN-F is violated, why are the "nasal' forms not simply identical to the input or basic form which is continuant-initial? To resolve the first of these problems I propose an OO-IDENT constraint, given in (23), that evaluates identity between members of a paradigm This constraint accounts for the fact that the feature value for [voiced] remains constant within a paradigm

(23) OO-IDENT$_{\mu}$(VCE)
Corresponding mutating consonants have identical values for the feature [voiced]

Since OO-IDENT$_{\mu}$(VCE) is never violated, we may justifiably rank it on a par with NAS/VC and above ALIGN-F As the tableau in (24) shows, OO-IDENT$_{\mu}$(VCE) rules out the possibility of voiced prenasalized stops, like candidate b, in the c-grade or nasal forms of voiceless consonant initial stems [7] The paradigm of output forms against which this form is compared is included in the input as π between slashes

(24) <u>*kofon*</u> 'knee' Cl 21

input hof-, [+nas], //π//	NAS/VC	OO-IDμ(VC)	ALIGN-F	STEM (hof-)
a nkof [+nasal]	*!			*
b ngof [+nasal]		*!		*
c ☞ kof			*	*

[7] That this is a principled and independently motivated constraint is supported, albeit in different guise, by Gnanadesikan (1997) who posits ternary scales in phonology Her arguments are particular pertinent to mutation systems which are generally ternary in nature

The same analysis applies to verbal stems, as shown in (25)

(25) *pina* 'wake up' pl

input fin-, [+nas], //π//	NAS/VC	OO-IDμ(VC)	ALIGN-F	STEM (fin-)
a mpin- [+nasal]	*!			*
b mbin- [+nasal]		*!		*
c ☞ pin			*	*

The one outstanding, and perhaps most difficult, problem now remaining is why voiceless stems exhibit voiceless stops rather than voiceless continuants in the nasal grade Both possibilities incur a violation of ALIGN-F, but the stop incurs an additional violation of continuant-initial STEMm which the continuant form does not We would thus predict the optimal form in both cases to be a voiceless continuant, namely *hof-* and *fin-* for the nasal grade examples in (22) This brings us to the heart of the discrepancy between morphological and phonological behavior in Pulaar mentioned in §1 0 When we look at the sequences of mutation grades in isolation and without regard to morphological behavior, what we see is a synchronic chain shift (Kirchner 1995) where stops are basic and either lenite to continuants or nasalize to prenasalized stops, as the diagram in (26) shows

(26)	LABIAL		CORONAL			DORSAL			
continuant	w	f	r	s	y	h	y	w	?
stop	b	p	d	c	ɟ	k	g	g	g
prenasalized	mb	p	nd	c	nɟ	k	ng	ng	ng

Taking the stops as a point of departure, lenition and prenasalization are fairly simple stepwise moves along a scale that goes from prenasalized stops to plain stops to continuants Positing stop-initial stems as basic (or underlying in derivational models of the grammar) would solve the problem from a phonological perspective Unfortunately for such an analysis, and as we have seen, there is no morphological motivation for lenition All evidence indicates that there are morphemes consisting of the feature [-continuant] and those consisting of [+nasal], but there is no morpheme that consists of the lenition provoking feature, [+continuant] Nevertheless, to reject the obvious phonological relationship between the stops and prenasalized stops is to throw the baby out with the bathwater By appealing to the extension of Correspondence theory that articulates output-to-output identity, we can propose an axis of correspondence or transderivational identity (Benua 1997) between the derived stop forms and the derived nasal stop forms In other words, voiceless continuant-initial stems appear as stop-initial rather than continuant-initial in the nasal grade because they are required by the identity constraint in (27) to look like stops

(27) $OO_{S/N}$-IDENT(CONT)
Corresponding mutating consonants in stop and nasal grades have identical values for the feature [continuant]

This constraint is never violated and is thus highly ranked, along with NAS/VC and OO-IDENT$_\mu$(VCE) The effects of both OO constraints (23) and (27) are illustrated in (28) The output form against which the nasal grade is compared, namely the stop form, *kof-*, is included in the input between double slashes

(28) *kofon* 'knee' Cl 21

input hof-, [+nas], //kof-//	NAS/VC	OO-IDμ(VC)	$OO_{S/N}$-ID(CONT)	ALIGN-F	STEM (hof-)
a nkof | [+nasal]	*!				*
b ngof | [+nasal]		*!			*
c ☞ kof				*	*
d hof			*!	*	

At this point, an objection could be raised to this analysis that it will not work for verbs While there are verbal stems that have stop-initial basic forms, verbal stems occur canonically in continuant and prenasalized-stop initial forms, or just the pattern that never occurs in nominal paradigms The problem lies in the fact that for voiceless verb stems like *fin-* 'wake up', there is no stop-initial form to which the nasal-initial form can correspond As a solution, I extend the notion of paradigm from that of verb to include a more formal, but unexceptional, definition of all forms that share a base This includes, of course, nominal derivatives such as agent nouns which do occur in stop-initial forms

The final ranking of the constraints discussed in this analysis is as follows

(29) NAS/VC, OO-IDENT$_\mu$(VCE), $OO_{S/N}$-IDENT(CONT) >> STEM-i >> ALIGN-F >> STEM-m

4.0 Glide mutations

While I have commented on and responded to potential counterarguments for this analysis of Pulaar consonant mutation during the course of the discussion, I have not yet addressed what has traditionally been viewed as one of the most challenging aspects of the system, namely the class of glide mutations, isolated in (30) In fact, it is primarily the nature of the glide mutations that Elzinga (1996) uses as evidence against positing continuant-initial forms as basic, thus no discussion of Pulaar mutation would be complete without addressing the issue

(30)	LABIAL	CORONAL	DORSAL		
a continuant	w	y	y	w	?
b stop	b	j	g	g	g
c Prenasalized	mb	nj	ng	ng	ng

With regard to the dorsal mutations, y occurs predictably before the front vowels, /i/ and /e/, while w occurs before the back vowels /o/ and /u/ Most previous analyses have not included the glottal stop mutation Although the glottal stop is the result of epenthesis since onsetless syllables are not allowed in Pulaar, I have included it here for the sake of consistency The problem that the glide mutations pose stems from the overlap of segments within a given grade which introduces an element of unpredictability into the system Positing basic continuants (whether within a non-derivational morpheme constraint based approach or a traditional derivational approach) makes it impossible to predict what the stop forms are going to be w can become either b or g and y can become either j or g This is the primary argument that has been used for positing the stops as basic forms My analysis of the glide mutations assumes that the representation of the labial glide w and the velar glide w are different, and that the representation of the coronal glide y and the dorsal glide y are different The difference lies simply in the major place nodes for which they are specified Thus, dorsal w will mutate to g or ng, while labial w will mutate to b, just as dorsal y will mutate to g and coronal y will mutate to j While independent phonetic evidence of distinct place features would greatly enhance my claim, I believe that the phonological evidence is sufficient

Finally, I would like to mention Paradis' (1987a) analysis of glide mutations in a related dialect of Pulaar Dispensing with labial w and coronal y as the unexceptional cases, she posits underlying X-slot-initial forms for the dorsal glide mutations, w and y By appealing to the theory of Charm and Government (Kaye, Lowenstamm & Vergnaud 1985) she then derives the glides from the association of features from the adjacent vowels to the X-slot, resulting in w before back vowels and y before front vowels, the perquisite distribution Paradis' analysis is, I believe, the correct one - but in diachronic terms The predictable occurrence of dorsal w before back vowels and dorsal y before front vowels is a historical artifact and plays no role in synchronic analysis Historically, the continuant series must have been the result of the lenition of stops, a view also held by Anderson (1976) and others This is evidenced by cognates in related languages Wolof and the more closely related Seereer-Siin (Mc Laughlin 1994), all of which occur in stop form in a manner similar to the example in (31)

(31) Cognates for 'man' in Pulaar, Seereer-Siin and Wolof

	Pulaar		Seereer-Siin	Wolof
Class 1	*gor-ko*	*o-koor*	*goor*	
Class 2	*wor-ƴe*	*goor-we*	*góor*	

Following Klingenheben (1927) Anderson claims that the lenited dorsal stop, ɣ, eventually disappeared from proto-Fula (Urful), and the glides replaced it Positing a proto-Fula ɣ would require further evidence, but whether it was there or not, Paradis' analysis would account for a later stage, between the time the lenited forms started to occur systematically, and the time they replaced the stop forms as basic That Paradis' analysis is accurate only in the historical context is evidenced by the fact that glide formation in onset position is no longer a productive process Evidence for this, as well as further evidence for positing continuant-initial basic forms, comes from the loanword data in §5

5 0 Loanword behavior

Due to historical circumstances Pulaar has borrowed extensively from French both directly and via Wolof, Senegal's lingua franca Where they begin with a mutating consonant, loanwords participate quite naturally in the mutation system Moreover, the mutation patterns that occur in loans provide convincing evidence that the operational class prefixes that cause mutation are [-continuant] and [+nasal] and that the plural (inter alia) prefix in the verbal system is [+nasal] Across the board, stems borrowed with stop-initial consonants systematically fail to undergo mutation to become continuant initial in their

Class 2 forms Those borrowed with continuant-initial stems, however, systematically undergo mutation to become stops in their Class 1 forms It is especially revealing to examine stop-initial loan paradigms with phonologically similar but continuant-initial non-loan stems Two such paradigms are the loans *baalde* 'to dance' and *pinde* 'to punish' form French *bal* and *punir* compared to the non-loan paradigms *waalde* 'to spend the night' and *finde* 'to wake up'

(32)

dance (<Fr) *bal*	spend the night	
baalde	*waalde*	infinitive
baala	*waala*	v singular
mbaala	*mbaala*	v plural
baaloowo	*baaloowo*	n Cl 1 (one who Xs)
*baaloɓe *waaloɓe*	*waaloɓe*	n Cl 2 (those who X)

(33)

punish (<Fr) *punir*	wake up	
pinde	*finde*	infinitive
pina	*fina*	v singular
pina	*pina*	v plural
pinoowo	*pinoowo*	n Cl 1 (one who Xs)
*pinooɓe *finooɓe*	*finooɓe*	n Cl 2 (those who X)

A continuant-initial form cannot be derived from a stop-initial base, but a stop-initial form is systematically produced from a continuant-initial form We would assume that loanwords follow the regular morphophonological patterns of Pulaar, thus favoring an analysis such as the one presented in this article, in which there are two types of stems — mutating (STEM-m) and immutable (STEM-i) Loan stems are simply incorporated wholesale into the grammar of Pulaar as instances of STEM-m, regardless of whether they are stop-initial or continuant-initial

Turning now to vowel-initial loans (34), we see that dorsal stop forms, both plain and prenasalized, are consistently derived from vowel-initial stems, presumably either as default consonants or via the epenthetic glottal stop The glides y and w, however, do not occur in continuant-initial forms, providing further evidence that the latter are not derived but basic This observation also supports the historical discussion in 4 0

(34)

reverse < Fr *arrière*	hem < Fr *ourler*	try < Fr *essayer*	
arieerde	*urlude*	*eseyde*	infinitive
arieera	*urla*	*eseya*	v singular
ngarieera	*ngurla*	*ngeseya*	v plural
garieroowo	*gurloowo*	*geseyoowo*	n Cl 1 (one who Xs)
arierooɓe	*urlooɓe*	*eseyooɓe*	n Cl 2 (those who X)

6 0 Summary and conclusion

In this study I have, like Elzinga (1996), argued for a morpheme-constraint based account of consonant mutation in Pulaar in which underlying representations are abandoned and the phonological shape of a morpheme is encoded directly in the constraint hierarchy By examining stem behavior I have shown that there are two types of featural morphemes that trigger consonant mutation, those consisting of the feature [-continuant] and those consisting of the feature [+nasal] An analysis in which the continuant-initial forms are basic provides several important advantages over a stop-initial analysis First, all instances of featural affixation, regardless of the feature, can be subsumed into a single constraint, ALIGN-F In a stop-initial analysis,on the other hand, different types of mutation have to be ranked between morpheme constraints Second, stems can be categorized as either mutating, STEM-m, or immutable, STEM-i, and no other stipulation is necessary for "partially mutating" stems as would be necessary in a stop-initial analysis Finally, the analysis is valid for both nominal and verbal stems Positing a stop-initial basic form for verbal stems is problematic, in that canonically, verbal stems are never stop-initial, alternating only between a continuant and a prenasalized stop, thereby forcing a continuant-initial analysis, even if one maintained a stop initial analysis for nominal stems [8] While there is no a priori reason that nominal stems and verbal stems should have the same type of basic form, the grammar of Pulaar is certainly rendered much simpler by a continuant-initial analysis which subsumes both nominal and verbal stems

With the basic shape of the argument laid out, I then addressed two additional issues why voiceless continuant-initial stems do not undergo prenasalization in the nasal grade, and given that they do not undergo prenasalization, why they appear as stops rather than continuants in the nasal grade The first of these issues is resolved by two highly ranked constraints NAS/VC which rules out voiceless prenasalized stops, and an OO identity constraint, OO-IDENT$_{m}$(VCE), that requires corresponding mutating consonants to have identical values for the feature [voiced] The second problem is resolved by an OO identity constraint, OO$_{S/N}$-IDENT(CONT), that requires a correspondence relation between stop and nasal grades with regard to the feature [continuant] This proposition follows in a principled manner on extensions of correspondence theory (McCarthy and Prince 1995) articulated by Benua (1997) and Gnanadesikan (1997)

Finally, I have addressed potential counterarguments to my analysis throughout the article, and have given special attention to problems with glide mutations The synchronic analysis is also highly compatible with a historical analysis of Pulaar consonant mutation, and further evidence for my position is provided by loanword data

In conclusion, a morpheme constraint based analysis, coupled with the insights of transderivational identity, allow for a principled and felicitous analysis of consonant mutation in Pulaar Furthermore, this analysis, which solves problematic issues that previous analyses have been unable to do, provides further evidence for the importance of surface-to-surface relationships between morphemes

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[8] It should be noted that Elzinga (1996) bases his analysis of consonant mutation in Fula solely on nominal stems

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